CHAPTER 10  Introduction to Economic Fluctuations | 301

QUESTIONS FOR REVIEW

1. When real GDP declines during a recession, what typically happens to consumption, investment, and the unemployment rate?

2. Give an example of a price that is sticky in the short run but flexible in the long run.

3. Why does the aggregate demand curve slope downward?

4. Explain the impact of an increase in the money supply in the short run and in the long run.

5. Why is it easier for the Fed to deal with demand shocks than with supply shocks?

PROBLEMS AND APPLICATIONS

1. An economy begins in long-run equilibrium, and then a change in government regulations allows banks to start paying interest on checking accounts. Recall that the money stock is the sum of currency and demand deposits, including checking accounts, so this regulatory change makes holding money more attractive.
   a. How does this change affect the demand for money?
   b. What happens to the velocity of money?
   c. If the Fed keeps the money supply constant, what will happen to output and prices in the short run and in the long run?
   d. If the goal of the Fed is to stabilize the price level, should the Fed keep the money supply constant in response to this regulatory change? If not, what should it do? Why?
   e. If the goal of the Fed is to stabilize output, how would your answer to part (d) change?

2. Suppose the Fed reduces the money supply by 5 percent. Assume the velocity of money is constant.
   a. What happens to the aggregate demand curve?
   b. What happens to the level of output and the price level in the short run and in the long run?

3. c. In light of your answer to part (b), what happens to unemployment in the short run and in the long run according to Okun's law?
   d. What happens to the real interest rate in the short run and in the long run? (Hint: Use the model of the real interest rate in Chapter 3 to see what happens when output changes.)

3. Let's examine how the goals of the Fed influence its response to shocks. Suppose that in scenario A the Fed cares only about keeping the price level stable and in scenario B the Fed cares only about keeping output and employment at their natural levels. Explain how in each scenario the Fed would respond to the following.
   a. An exogenous decrease in the velocity of money.
   b. An exogenous increase in the price of oil.

4. The official arbiter of when recessions begin and end is the National Bureau of Economic Research, a nonprofit economics research group. Go to the NBER's Web site (www.nber.org) and find the latest turning point in the business cycle. When did it occur? Was this a switch from expansion to contraction or the other way around? List all the recessions (contractions) that have occurred during your lifetime and the dates when they began and ended.
income and the interest rate. A higher level of income raises the demand for real money balances, and this in turn raises the interest rate. The upward-sloping LM curve summarizes this positive relationship between income and the interest rate.

5. The IS–LM model combines the elements of the Keynesian cross and the elements of the theory of liquidity preference. The IS curve shows the points that satisfy equilibrium in the goods market, and the LM curve shows the points that satisfy equilibrium in the money market. The intersection of the IS and LM curves shows the interest rate and income that satisfy equilibrium in both markets for a given price level.

KEY CONCEPTS

**IS–LM model**

**IS curve**

**LM curve**

**Keynesian cross**

**Government-purchases multiplier**

**Tax multiplier**

**Theory of liquidity preference**

QUESTIONS FOR REVIEW

1. Use the Keynesian cross to explain why fiscal policy has a multiplied effect on national income.
2. Use the theory of liquidity preference to explain why an increase in the money supply lowers the interest rate. What does this explanation assume about the price level?
3. Why does the IS curve slope downward?
4. Why does the LM curve slope upward?

PROBLEMS AND APPLICATIONS

1. Use the Keynesian cross to predict the impact on equilibrium GDP of the following. In each case, state the direction of the change and give a formula for the size of the impact.
   a. An increase in government purchases
   b. An increase in taxes
   c. Equal-sized increases in both government purchases and taxes
2. In the Keynesian cross, assume that the consumption function is given by

   \[ C = 200 + 0.75 \cdot (Y - T). \]

   Planned investment is 100; government purchases and taxes are both 100.
   a. Graph planned expenditure as a function of income.
   b. What is the equilibrium level of income?
   c. If government purchases increase to 125, what is the new equilibrium income?
   d. What level of government purchases is needed to achieve an income of 1,600?
3. Although our development of the Keynesian cross in this chapter assumes that taxes are a
fixed amount, most countries levy some taxes
that rise automatically with national income.
(Examples in the United States include the
income tax and the payroll tax.) Let's represent
the tax system by writing tax revenue as
\[ T = \bar{T} + tY, \]
where \( \bar{T} \) and \( t \) are parameters of the tax code.
The parameter \( t \) is the marginal tax rate: if
income rises by \$1, taxes rise by \( t \times \$1 \).

a. How does this tax system change the way
consumption responds to changes in GDP?

b. In the Keynesian cross, how does this tax
system alter the government-purchases
multiplier?

c. In the IS–LM model, how does this tax
system alter the slope of the IS curve?

4. Consider the impact of an increase in thriftiness
in the Keynesian cross. Suppose the consumption
function is
\[ C = \bar{C} + \epsilon(Y - T), \]
where \( \bar{C} \) is a parameter called autonomous
consumption and \( \epsilon \) is the marginal propensity to
consume.

a. What happens to equilibrium income when
the society becomes more thrifty, as represented
by a decline in \( \bar{C} \)?

b. What happens to equilibrium saving?

c. Why do you suppose this result is called the
paradox of thrift?

d. Does this paradox arise in the classical model
of Chapter 3? Why or why not?

5. Suppose that the money demand function is
\[ (M/P)^d = 1,000 - 100r, \]
where \( r \) is the interest rate in percent. The
money supply \( M \) is 1,000 and the price level \( P \)
is 2.

a. Graph the supply and demand for real money
balances.

b. What is the equilibrium interest rate?

c. Assume that the price level is fixed. What
happens to the equilibrium interest rate if the
supply of money is raised from 1,000 to 1,200?

d. If the Fed wishes to raise the interest rate to
7 percent, what money supply should it set?

6. The following equations describe an economy.
\[ Y = C + I + G. \]
\[ C = 120 + 0.5(Y - T). \]
\[ I = 100 - 10r. \]
\[ G = 50. \]
\[ T = 40. \]
\[ (M/P)^d = Y - 20r. \]
\[ M = 600. \]
\[ P = 2. \]

a. Identify each of the variables and briefly
explain their meaning.

b. From the above list, use the relevant set of
equations to derive the IS curve. Graph the
IS curve on an appropriately labeled graph.

c. From the above list, use the relevant set of
equations to derive the LM curve. Graph the
LM curve on the same graph you used in
part (b).

d. What are the equilibrium level of income and
equilibrium interest rate?
5. Expansionary monetary policy shifts the LM curve downward. This shift in the LM curve lowers the interest rate and raises income. The increase in income represents a rightward shift of the aggregate demand curve. Similarly, contractionary monetary policy shifts the LM curve upward, raises the interest rate, lowers income, and shifts the aggregate demand curve to the left.

**KEY CONCEPTS**

Monetary transmission mechanism  Pigou effect  Debt-deflation theory

**QUESTIONS FOR REVIEW**

1. Explain why the aggregate demand curve slopes downward.
2. What is the impact of an increase in taxes on the interest rate, income, consumption, and investment?
3. What is the impact of a decrease in the money supply on the interest rate, income, consumption, and investment?
4. Describe the possible effects of falling prices on equilibrium income.

**PROBLEMS AND APPLICATIONS**

1. According to the IS–LM model, what happens in the short run to the interest rate, income, consumption, and investment under the following circumstances? Be sure your answer includes an appropriate graph.
   a. The central bank increases the money supply.
   b. The government increases government purchases.
   c. The government increases taxes.
   d. The government increases government purchases and taxes by equal amounts.
2. Use the IS–LM model to predict the short-run effects of each of the following shocks on income, the interest rate, consumption, and investment. In each case, explain what the Fed should do to keep income at its initial level.
   a. After the invention of a new high-speed computer chip, many firms decide to upgrade their computer systems.
   b. A wave of credit card fraud increases the frequency with which people make transactions in cash.
   c. A best-seller titled *Retire Rich* convinces the public to increase the percentage of their income devoted to saving.
   d. The appointment of a new “dovish” Federal Reserve chairman increases expected inflation.
3. Consider the economy of Hicksonia.
   a. The consumption function is given by
      \[ C = 200 + 0.75(Y - T). \]
      The investment function is
      \[ I = 200 - 25r. \]
      Government purchases and taxes are both 100. For this economy, graph the IS curve for \( r \) ranging from 0 to 8.
   b. The money demand function in Hicksonia is
      \[ (M/P)^d = Y - 100r. \]
      The money supply \( M \) is 1,000 and the price level \( P \) is 2. For this economy, graph the LM curve for \( r \) ranging from 0 to 8.
c. Find the equilibrium interest rate \( r \) and the equilibrium level of income \( Y \).

d. Suppose that government purchases are raised from 100 to 150. How does the IS curve shift? What are the new equilibrium interest rate and level of income?

e. Suppose instead that the money supply is raised from 1,000 to 1,200. How does the \( LM \) curve shift? What are the new equilibrium interest rate and level of income?

f. With the initial values for monetary and fiscal policy, suppose that the price level rises from 2 to 4. What happens? What are the new equilibrium interest rate and level of income?

g. Derive and graph an equation for the aggregate demand curve. What happens to this aggregate demand curve if fiscal or monetary policy changes, as in parts (d) and (e)?

4. Determine whether each of the following statements is true or false, and explain why. For each true statement, discuss the impact of monetary and fiscal policy in that special case.

a. If investment does not depend on the interest rate, the \( LM \) curve is horizontal.

b. If investment does not depend on the interest rate, the IS curve is vertical.

c. If money demand does not depend on the interest rate, the IS curve is horizontal.

d. If money demand does not depend on the interest rate, the \( LM \) curve is vertical.

e. If money demand does not depend on income, the \( LM \) curve is horizontal.

f. If money demand is extremely sensitive to the interest rate, the \( LM \) curve is horizontal.

5. Monetary policy and fiscal policy often change at the same time.

a. Suppose that the government wants to raise investment but keep output constant. In the IS–LM model, what mix of monetary and fiscal policy will achieve this goal?

b. In the early 1980s, the U.S. government cut taxes and ran a budget deficit while the Fed pursued a tight monetary policy. What effect should this policy mix have?

6. Use the IS–LM diagram to describe both the short-run effects and the long-run effects of the following changes on national income, the interest rate, the price level, consumption, investment, and real money balances.

a. An increase in the money supply

b. An increase in government purchases

c. An increase in taxes

7. The Fed is considering two alternative monetary policies:
   - holding the money supply constant and letting the interest rate adjust, or
   - adjusting the money supply to hold the interest rate constant.

In the IS–LM model, which policy will better stabilize output under the following conditions? Explain your answer.

a. All shocks to the economy arise from exogenous changes in the demand for goods and services.

b. All shocks to the economy arise from exogenous changes in the demand for money.

8. Suppose that the demand for real money balances depends on disposable income. That is, the money demand function is

\[
M/P = L(r, Y - T).
\]

Using the IS–LM model, discuss whether this change in the money demand function alters the following.

a. The analysis of changes in government purchases

b. The analysis of changes in taxes

9. This problem asks you to analyze the IS–LM model algebraically. Suppose consumption is a linear function of disposable income:

\[
C(Y - T) = a + b(Y - T),
\]

where \( a > 0 \) and \( 0 < b < 1 \). The parameter \( b \) is the marginal propensity to consume, and the parameter \( a \) is a constant sometimes called autonomous consumption. Suppose also that investment is a linear function of the interest rate:

\[
I(r) = \epsilon - dr.
\]

where \( \epsilon > 0 \) and \( d > 0 \). The parameter \( d \) measures the sensitivity of investment to the interest
rate, and the parameter \(c\) is a constant sometimes called autonomous investment.

a. Solve for \(Y\) as a function of \(r\), the exogenous variables \(G\) and \(T\), and the model’s parameters \(a\), \(b\), \(c\), and \(d\).

b. How does the slope of the IS curve depend on the parameter \(d\), the interest sensitivity of investment? Refer to your answer to part (a), and explain the intuition.

c. Which will cause a bigger horizontal shift in the IS curve, a $100 tax cut or a $100 increase in government spending? Refer to your answer to part (a), and explain the intuition.

Now suppose demand for real money balances is a linear function of income and the interest rate:

\[
L(r, Y) = eY - fr,
\]

where \(e > 0\) and \(f > 0\). The parameter \(e\) measures the sensitivity of money demand to income, while the parameter \(f\) measures the sensitivity of money demand to the interest rate.

d. Solve for \(r\) as a function of \(Y\), \(M\), and \(P\) and the parameters \(e\) and \(f\).

e. Using your answer to part (d), determine whether the \(LM\) curve is steeper for large or small values of \(f\), and explain the intuition.

f. How does the size of the shift in the \(LM\) curve resulting from a $100 increase in \(M\) depend on

i. the value of the parameter \(e\), the income sensitivity of money demand?

ii. the value of the parameter \(f\), the interest sensitivity of money demand?

g. Use your answers to parts (a) and (d) to derive an expression for the aggregate demand curve. Your expression should show \(Y\) as a function of \(P\); of exogenous policy variables \(M\), \(G\), and \(T\); and of the model’s parameters. This expression should not contain \(r\).

h. Use your answer to part (g) to prove that the aggregate demand curve has a negative slope.

i. Use your answer to part (g) to prove that increases in \(G\) and \(M\), and decreases in \(T\), shift the aggregate demand curve to the right. How does this result change if the parameter \(f\), the interest sensitivity of money demand, equals zero? Explain the intuition for your result.
expansionary impact on aggregate income. Fiscal policy does influence aggregate income under fixed exchange rates.

3. The Mundell–Fleming model shows that monetary policy does not influence aggregate income under fixed exchange rates. Any attempt to expand the money supply is futile because the money supply must adjust to ensure that the exchange rate stays at its announced level. Monetary policy does influence aggregate income under floating exchange rates.

4. If investors are wary of holding assets in a country, the interest rate in that country may exceed the world interest rate by some risk premium. According to the Mundell–Fleming model, if a country has a floating exchange rate, an increase in the risk premium causes the interest rate to rise and the currency of that country to depreciate.

5. There are advantages to both floating and fixed exchange rates. Floating exchange rates leave monetary policymakers free to pursue objectives other than exchange-rate stability. Fixed exchange rates reduce some of the uncertainty in international business transactions, but they may be subject to speculative attack if international investors believe the central bank does not have sufficient foreign-currency reserves to defend the fixed exchange rate. When choosing an exchange-rate regime, policymakers are constrained by the fact that it is impossible for a nation to have free capital flows, a fixed exchange rate, and independent monetary policy.

**KEY CONCEPTS**

<table>
<thead>
<tr>
<th>Mundell–Fleming model</th>
<th>Fixed exchange rates</th>
<th>Revaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floating exchange rates</td>
<td>Devaluation</td>
<td>Impossible trinity</td>
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**QUESTIONS FOR REVIEW**

1. In the Mundell–Fleming model with floating exchange rates, explain what happens to aggregate income, the exchange rate, and the trade balance when taxes are raised. What would happen if exchange rates were fixed rather than floating?

2. In the Mundell–Fleming model with floating exchange rates, explain what happens to aggregate income, the exchange rate, and the trade balance when the money supply is reduced. What would happen if exchange rates were fixed rather than floating?

3. In the Mundell–Fleming model with floating exchange rates, explain what happens to aggregate income, the exchange rate, and the trade balance when a quota on imported cars is removed. What would happen if exchange rates were fixed rather than floating?

4. What are the advantages of floating exchange rates and fixed exchange rates?

5. Describe the impossible trinity.
1. Use the Mundell–Fleming model to predict what would happen to aggregate income, the exchange rate, and the trade balance under both floating and fixed exchange rates in response to each of the following shocks. Be sure to include an appropriate graph in your answer.
   a. A fall in consumer confidence about the future induces consumers to spend less and save more.
   b. The introduction of a stylish line of Toyotas makes some consumers prefer foreign cars over domestic cars.
   c. The introduction of automatic teller machines reduces the demand for money.

2. A small open economy with a floating exchange rate is in recession with balanced trade. If policymakers want to reach full employment while maintaining balanced trade, what combination of monetary and fiscal policy should they choose? Use a graph, and be sure to identify the effects of each policy.

3. The Mundell–Fleming model takes the world interest rate \( r^* \) as an exogenous variable. Let’s consider what happens when this variable changes.
   a. What might cause the world interest rate to rise? (Hint: The world is a closed economy.)
   b. In the Mundell–Fleming model with a floating exchange rate, what happens to aggregate income, the exchange rate, and the trade balance when the world interest rate rises?
   c. In the Mundell–Fleming model with a fixed exchange rate, what happens to aggregate income, the exchange rate, and the trade balance when the world interest rate rises?

4. Business executives and policymakers are often concerned about the competitiveness of American industry (the ability of U.S. industries to sell their goods profitably in world markets).
   a. How would a change in the nominal exchange rate affect competitiveness in the short run when prices are sticky?
   b. Suppose you wanted to make domestic industries more competitive but did not want to alter aggregate income. According to the Mundell–Fleming model, what combination of monetary and fiscal policies should you pursue? Use a graph, and be sure to identify the effects of each policy.

5. Suppose that higher income implies higher imports and thus lower net exports. That is, the net-exports function is
   \[ NX = NX(e, Y). \]
   Examine the effects in a small open economy of a fiscal expansion on income and the trade balance under the following exchange-rate regimes.
   a. A floating exchange rate
   b. A fixed exchange rate
   How does your answer compare to the results in Table 13-1?

6. Suppose that money demand depends on disposable income, so that the equation for the money market becomes
   \[ M/P = L(r, Y - T). \]
   Analyze the short-run impact of a tax cut in a small open economy on the exchange rate and income under both floating and fixed exchange rates.

7. Suppose that the price level relevant for money demand includes the price of imported goods and that the price of imported goods depends on the exchange rate. That is, the money market is described by
   \[ M/P = L(r, Y), \]
   where
   \[ P = \lambda P_d + (1 - \lambda)P_f/e. \]
   Here, \( P_d \) is the price of domestic goods, \( P_f \) is the price of foreign goods measured in the foreign currency, and \( e \) is the exchange rate. Thus, \( P_f/e \) is the price of foreign goods measured in the domestic currency. The parameter \( \lambda \) is the share of domestic goods in the price index \( P \). Assume that the price of domestic goods \( P_d \) and
the price of foreign goods measured in foreign currency \( P_f \) are sticky in the short run.

a. Suppose that we graph the \( LM^* \) curve for given values of \( P_d \) and \( P_f \) (instead of the usual \( P \)). Is this \( LM^* \) curve still vertical? Explain.

b. What is the effect of expansionary fiscal policy under floating exchange rates in this model? Explain. Contrast with the standard Mundell–Fleming model.

c. Suppose that political instability increases the country risk premium and, thereby, the interest rate. What is the effect on the exchange rate, the price level, and aggregate income in this model? Contrast with the standard Mundell–Fleming model.

d. If California suffers from a recession, should the state government use monetary or fiscal policy to stimulate employment? Explain. (Note: For this question, assume that the state government can print dollar bills.)

c. If California prohibited the import of wines from the state of Washington, what would happen to income, the exchange rate, and the trade balance? Consider both the short-run and the long-run impacts.

d. Can you think of any important features of the Californian economy that are different from, say, the Canadian economy and that might make the Mundell–Fleming model less useful when applied to California than to Canada?

8. Use the Mundell–Fleming model to answer the following questions about the state of California (a small open economy).

a. What kind of exchange-rate system does California have with its major trading partners (Alabama, Alaska, Arizona, . . .)?
We can now see that the monetary transmission mechanism works through two channels in a large open economy. As in a closed economy, a monetary expansion lowers the interest rate, which stimulates investment. As in a small open economy, a monetary expansion causes the currency to depreciate in the market for foreign exchange, which stimulates net exports. Both effects result in a higher level of aggregate income. Indeed, because the IS curve is flatter here than it is in a closed economy, any given shift in the LM curve will have a larger impact on income.

A Rule of Thumb

This model of the large open economy describes well the U.S. economy today. Yet it is somewhat more complicated and cumbersome than the model of the closed economy we studied in Chapters 11 and 12 and the model of the small open economy we developed in this chapter. Fortunately, there is a useful rule of thumb to help you determine how policies influence a large open economy without remembering all the details of the model: The large open economy is an average of the closed economy and the small open economy. To find how any policy will affect any variable, find the answer in the two extreme cases and take an average.

For example, how does a monetary contraction affect the interest rate and investment in the short run? In a closed economy, the interest rate rises, and investment falls. In a small open economy, neither the interest rate nor investment changes. The effect in the large open economy is an average of these two cases: a monetary contraction raises the interest rate and reduces investment, but only somewhat. The fall in the net capital outflow mitigates the rise in the interest rate and the fall in investment that would occur in a closed economy. But unlike in a small open economy, the international flow of capital is not so strong as to fully negate these effects.

This rule of thumb makes the simple models all the more valuable. Although they do not describe perfectly the world in which we live, they do provide a useful guide to the effects of economic policy.

MORE PROBLEMS AND APPLICATIONS

1. Imagine that you run the central bank in a large open economy with a floating exchange rate. Your goal is to stabilize income, and you adjust the money supply accordingly. Under your policy, what happens to the money supply, the interest rate, the exchange rate, and the trade balance in response to each of the following shocks?
   a. The president raises taxes to reduce the budget deficit.
   b. The president restricts the import of foreign cars.

2. Over the past several decades, the economies of the world have become more financially integrated. That is, investors in all nations have become more willing and able to take advantage of financial opportunities abroad. Consider how this development affects the ability of monetary policy to influence the economy.
   a. If investors become more willing and able to substitute foreign and domestic assets, what happens to the slope of the CF function?
b. If the $CF$ function changes in this way, what happens to the slope of the $IS$ curve?

c. How does this change in the $IS$ curve affect the Fed's ability to control the interest rate?

d. How does this change in the $IS$ curve affect the Fed's ability to control national income?

3. Suppose that policymakers in a large open economy want to raise the level of investment without changing aggregate income or the exchange rate.

a. Is there any combination of domestic monetary and fiscal policies that would achieve this goal?

b. Is there any combination of domestic monetary, fiscal, and trade policies that would achieve this goal?

c. Is there any combination of monetary and fiscal policies at home and abroad that would achieve this goal?

4. This appendix considers the case of a large open economy with a floating exchange rate, but suppose instead that a large open economy has a fixed exchange rate. That is, the central bank announces a target for the exchange rate and commits itself to adjusting the money supply to ensure that the equilibrium exchange rate equals the target.

a. Describe what happens to income, the interest rate, and the trade balance in response to a fiscal expansion, such as an increase in government purchases. Compare your answer to the case of a small open economy with a fixed exchange rate.

b. Describe what happens to income, the interest rate, and the trade balance if the central bank expands the money supply by buying bonds from the public. Compare your answer to the case of a small open economy with a fixed exchange rate.
KEY CONCEPTS

Sticky-price model  Demand-pull inflation  Rational expectations
Imperfect-information model  Cost-push inflation  Natural-rate hypothesis
Phillips curve  Sacrifice ratio  Hysteresis
Adaptive expectations

QUESTIONS FOR REVIEW

1. Explain the two theories of aggregate supply. On what market imperfection does each theory rely? What do the theories have in common?

2. How is the Phillips curve related to aggregate supply?

3. Why might inflation be inertial?

4. Explain the differences between demand-pull inflation and cost-push inflation.

5. Under what circumstances might it be possible to reduce inflation without causing a recession?

6. Explain two ways in which a recession might raise the natural rate of unemployment.

PROBLEMS AND APPLICATIONS

1. In the sticky-price model, describe the aggregate supply curve in the following special cases. How do these cases compare to the short-run aggregate supply curve we discussed in Chapter 10?
   a. All firms have sticky prices (s = 1).
   b. The desired price does not depend on aggregate output (a = 0).

2. Suppose that an economy has the Phillips curve
   \[ \pi = \pi_{-1} - 0.5(u - 0.06) \]
   a. What is the natural rate of unemployment?
   b. Graph the short-run and long-run relationships between inflation and unemployment.
   c. How much cyclical unemployment is necessary to reduce inflation by 5 percentage points? Using Okun’s law, compute the sacrifice ratio.
   d. Inflation is running at 10 percent. The Fed wants to reduce it to 5 percent. Give two scenarios that will achieve that goal.

3. According to the rational-expectations approach, if everyone believes that policymakers are committed to reducing inflation, the cost of reducing inflation—the sacrifice ratio—will be lower than if the public is skeptical about the policymakers’ intentions. Why might this be true? How might credibility be achieved?

4. Suppose that the economy is initially at a long-run equilibrium. Then the Fed increases the money supply.
   a. Assuming any resulting inflation to be unexpected, explain any changes in GDP, unemployment, and inflation that are caused by the monetary expansion. Explain your conclusions using three diagrams: one for the IS–LM model, one for the AD–AS model, and one for the Phillips curve.
   b. Assuming instead that any resulting inflation is expected, explain any changes in GDP, unemployment, and inflation that are caused by the monetary expansion. Once again, explain your conclusions using three diagrams: one for the IS–LM model, one for the AD–AS model, and one for the Phillips curve.

5. Assume that people have rational expectations and that the economy is described by the sticky-price model. Explain why each of the following propositions is true.
   a. Only unanticipated changes in the money supply affect real GDP. Changes in the money
supply that were anticipated when prices were set do not have any real effects.
b. If the Fed chooses the money supply at the same time as people are setting prices, so that everyone has the same information about the state of the economy, then monetary policy cannot be used systematically to stabilize output. Hence, a policy of keeping the money supply constant will have the same real effects as a policy of adjusting the money supply in response to the state of the economy. (This is called the policy irrelevance proposition.)
c. If the Fed sets the money supply well after people have set prices, so that the Fed has collected more information about the state of the economy, then monetary policy can be used systematically to stabilize output.

6. Suppose that an economy has the Phillips curve

\[ \pi = \pi_{t-1} - 0.5(u - u^*) \]

and that the natural rate of unemployment is given by an average of the past two years' unemployment:

\[ u^* = 0.5(u_{t-1} + u_{t-2}) \]

a. Why might the natural rate of unemployment depend on recent unemployment (as is assumed in the preceding equation)?
b. Suppose that the Fed follows a policy to permanently reduce the inflation rate by 1 percentage point. What effect will that policy have on the unemployment rate over time?
c. What is the sacrifice ratio in this economy? Explain.
d. What do these equations imply about the short-run and long-run tradeoffs between inflation and unemployment?

7. Some economists believe that taxes have an important effect on the labor supply. They argue that higher taxes cause people to want to work less and that lower taxes cause them to want to work more. Consider how this effect alters the macroeconomic analysis of tax changes.
a. If this view is correct, how does a tax cut affect the natural level of output?
b. How does a tax cut affect the aggregate demand curve? The long-run aggregate supply curve? The short-run aggregate supply curve?
c. What is the short-run impact of a tax cut on output and the price level? How does your answer differ from the case without the labor-supply effect?
d. What is the long-run impact of a tax cut on output and the price level? How does your answer differ from the case without the labor-supply effect?

8. Economist Alan Blinder, a previous vice chairman of the Federal Reserve, once wrote the following:

The costs that attend the low and moderate inflation rates experienced in the United States and in other industrial countries appear to be quite modest—more like a bad cold than a cancer on society. . . . As rational individuals, we do not volunteer for a lobotomy to cure a head cold. Yet, as a collectivity, we routinely prescribe the economic equivalent of lobotomy (high unemployment) as a cure for the inflationary cold.\(^{14}\)

What do you think Blinder meant by this? What are the policy implications of the viewpoint Blinder is advocating? Do you agree? Why or why not?

9. Go to the Web site of the Bureau of Labor Statistics (www.bls.gov). For each of the past five years, find the inflation rate as measured by the consumer price index for all items (sometimes called headline inflation) and as measured by the CPI excluding food and energy (sometimes called core inflation). Compare these two measures of inflation. Why might they be different? What might the difference tell you about shifts in the aggregate supply curve and in the short-run Phillips curve?

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2. **Closed or Open?** You decide whether you want a closed economy (which occurs when the capital flow \( CF \) always equals zero) or an open economy (which allows \( CF \) to differ from zero).

3. **Small or Large?** If you want an open economy, you decide whether you want a small one (in which \( CF \) is infinitely elastic at the world interest rate \( r^* \)) or a large one (in which the domestic interest rate is not pinned down by the world rate).

4. **Floating or Fixed?** If you are examining a small open economy, you decide whether the exchange rate is floating (in which case the central bank sets the money supply) or fixed (in which case the central bank allows the money supply to adjust).

5. **Fixed Velocity?** If you are considering a closed economy with the Keynesian assumption of fixed prices, you decide whether you want to focus on the special case in which velocity is exogenously fixed.

By making this series of modeling decisions, you move from the more complete and complex model to a simpler, more narrowly focused special case that is easier to understand and use.

When thinking about the real world, it is important to keep in mind all the models and their simplifying assumptions. Each of these models provides insight into some facet of the economy.

---

**More Problems and Applications**

1. Let's consider some more special cases of the mother of all models. Starting with this comprehensive model, what extra assumptions would you need to yield each of the following specialized models?
   a. The model of the classical large open economy in the appendix to Chapter 6.
   b. The Keynesian cross in the first half of Chapter 11.
   c. The \( IS-LM \) model for the large open economy in the appendix to Chapter 13.
QUESTIONS FOR REVIEW

1. On a carefully labeled graph, draw the dynamic aggregate supply curve. Explain why it has the slope it has.
2. On a carefully labeled graph, draw the dynamic aggregate demand curve. Explain why it has the slope it has.
3. A central bank has a new head, who decides to raise the target inflation rate from 2 to 3 percent. Using a graph of the dynamic AD–AS model, show the effect of this change. What happens to the nominal interest rate immediately upon the change in policy and in the long run? Explain.
4. A central bank has a new head, who decides to increase the response of interest rates to inflation. How does this change in policy alter the response of the economy to a supply shock? Give both a graphical answer and a more intuitive economic explanation.

PROBLEMS AND APPLICATIONS

1. Derive the long-run equilibrium for the dynamic AD–AS model. Assume there are no shocks to demand or supply ($\epsilon_t = \nu_t = 0$) and inflation has stabilized ($\pi_t = \pi_{t-1}$), and then use the five equations in Table 15-1 to derive the value of each variable in the model. Be sure to show each step you follow.
2. Suppose the monetary-policy rule has the wrong natural rate of interest. That is, the central bank follows this rule:

$$i_t = \pi_t + \rho' + \theta_\pi (\pi_t - \pi^*) + \theta_\psi (Y_t - Y^*)$$

where $\rho'$ does not equal $\rho$, the natural rate of interest in the equation for goods demand. The rest of the dynamic AD–AS model is the same as in the chapter. Solve for the long-run equilibrium under this policy rule. Explain in words the intuition behind your solution.
3. "If a central bank wants to achieve lower nominal interest rates, it has to raise the nominal interest rate." Explain in what way this statement makes sense.
4. The sacrifice ratio is the accumulated loss in output that results when the central bank lowers its target for inflation by 1 percentage point. For the parameters used in the text simulation (see the FY1 box), what is the implied sacrifice ratio? Explain.
5. The text analyzes the case of a temporary shock to the demand for goods and services. Suppose, however, that $\epsilon_t$ were to increase permanently. What would happen to the economy over time? In particular, would the inflation rate return to its target in the long run? Why or why not? (Hint: It might be helpful to solve for the long-run equilibrium without the assumption that $\epsilon_t$ equals zero.) How might the central bank alter its policy rule to deal with this issue?
6. Suppose a central bank does not satisfy the Taylor principle; that is, $\theta_\pi$ is less than zero. Use a graph to analyze the impact of a supply shock. Does this analysis contradict or reinforce the Taylor principle as a guideline for the design of monetary policy?
7. The text assumes that the natural rate of interest $\rho$ is a constant parameter. Suppose instead that it varies over time, so now it has to be written as $\rho_t$.

a. How would this change affect the equations for dynamic aggregate demand and dynamic aggregate supply?

b. How would a shock to $\rho_t$ affect output, inflation, the nominal interest rate, and the real interest rate?

c. Can you see any practical difficulties that a central bank might face if $\rho_t$ varied over time?
8. Suppose that people's expectations of inflation are subject to random shocks. That is, instead of being merely adaptive, expected inflation in period $t$, as seen in period $t-1$, is $E_{t-1}\pi_t = \pi_{t-1} + \eta_{t-1}$, where
\[ \eta_{t-1} \] is a random shock. This shock is normally zero, but it deviates from zero when some event beyond past inflation causes expected inflation to change. Similarly, \( E_t \pi_{t+1} = \pi_t + \eta_t \).

9. Use the dynamic AD–AS model to solve for inflation as a function of only lagged inflation and supply and demand shocks. (Assume target inflation is constant.)

   a. According to the equation you have derived, does inflation return to its target after a shock? Explain. (Hint: Look at the coefficient on lagged inflation.)

   b. Suppose the central bank does not respond to changes in output but only to changes in inflation, so that \( \theta_r = 0 \). How, if at all, would this fact change your answer to part (a)?

   c. Suppose the central bank does not respond to changes in inflation but only to changes in output, so that \( \theta_r = 0 \). How, if at all, would this fact change your answer to part (a)?

   d. Suppose the central bank does not follow the Taylor principle but instead raises the nominal interest rate only 0.8 percentage point for each percentage-point increase in inflation. In this case, what is \( \theta_r \)? How does a shock to demand or supply influence the path of inflation?

b. Suppose that the economy experiences an inflation scare. That is, in period \( t \), for some reason people come to believe that inflation in period \( t + 1 \) is going to be higher, so \( \eta_t \) is greater than zero (for this period only). What happens to the DAD and DAS curves in period \( t \) and \( t + 1 \)? What happens to output, inflation, and nominal and real interest rates in that period? Explain.

c. What happens to the DAD and DAS curves in period \( t + 1 \)? What happens to output, inflation, and nominal and real interest rates in that period? Explain.

d. What happens to the economy in subsequent periods?

e. In what sense are inflation scares self-fulfilling?
QUESTIONS FOR REVIEW

1. What were Keynes's three conjectures about the consumption function?

2. Describe the evidence that was consistent with Keynes's conjectures and the evidence that was inconsistent with them.

3. How do the life-cycle and permanent-income hypotheses resolve the seemingly contradictory pieces of evidence regarding consumption behavior?

4. Use Fisher's model of consumption to analyze an increase in second-period income. Compare the case in which the consumer faces a binding borrowing constraint and the case in which he does not.

5. Explain why changes in consumption are unpredictable if consumers obey the permanent-income hypothesis and have rational expectations.

6. Give an example in which someone might exhibit time-inconsistent preferences.

PROBLEMS AND APPLICATIONS

1. The chapter uses the Fisher model to discuss a change in the interest rate for a consumer who saves some of his first-period income. Suppose, instead, that the consumer is a borrower. How does that alter the analysis? Discuss the income and substitution effects on consumption in both periods.

2. Jack and Jill both obey the two-period Fisher model of consumption. Jack earns $100 in the first period and $100 in the second period. Jill earns nothing in the first period and $210 in the second period. Both of them can borrow or lend at the interest rate $r$.

   a. You observe both Jack and Jill consuming $100 in the first period and $100 in the second period. What is the interest rate $r$?

   b. Suppose the interest rate increases. What will happen to Jack's consumption in the first period? Is Jack better off or worse off than before the interest rate rise?

   c. What will happen to Jill's consumption in the first period when the interest rate increases? Is Jill better off or worse off than before the interest rate increase?

3. The chapter analyzes Fisher's model for the case in which the consumer can save or borrow at an interest rate of $r$ and for the case in which the consumer can save at this rate but cannot borrow at all. Consider now the intermediate case in which the consumer can save at rate $r_i$ and borrow at rate $r_b$, where $r_i < r_b$.

   a. What is the consumer's budget constraint in the case in which he consumes less than his income in period one? Answer in the form of an equation.

   b. What is the consumer's budget constraint in the case in which he consumes more than his income in period one? Answer in the form of an equation.

   c. On a single graph, show the two budget constraints from parts (a) and (b). Shade the area that represents the combination of first-period and second-period consumption the consumer can choose.

   d. Now add to your graph the consumer's indifference curves. Show three possible outcomes: one in which the consumer saves, one in which he borrows, and one in which he neither saves nor borrows.

   e. What determines first-period consumption in each of the three cases?

4. Explain whether borrowing constraints increase or decrease the potency of fiscal policy to influence aggregate demand in each of the following cases.

   a. A temporary tax cut

   b. An announced future tax cut
5. Dave and Christy both follow the life-cycle hypothesis: they smooth consumption as much as possible. They each live for five periods, the last two of which are retirement. Here are their incomes earned during each period:

<table>
<thead>
<tr>
<th>Period</th>
<th>Dave</th>
<th>Christy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$100,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>2</td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>3</td>
<td>100,000</td>
<td>160,000</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

They both die at the beginning of period six. To keep things simple, assume that the interest rate is zero for both saving and borrowing and that the life span is perfectly predictable.

a. For each individual, compute consumption and saving in each period of life.

b. Compute their wealth (that is, their accumulated saving) at the beginning of each period, including period six.

c. Graph consumption, income, and wealth for each of them, with the period on the horizontal axis. Compare your graph to Figure 16-12.

d. Suppose now that consumers cannot borrow, so wealth cannot be negative. How does that change your answers above? Draw a new graph for part (c) if necessary.

6. Demographers predict that the fraction of the population that is elderly will increase over the next 20 years. What does the life-cycle model predict for the influence of this demographic change on the national saving rate?

7. A Case Study in the chapter indicates that the elderly do not dissave as much as the life-cycle model predicts.

a. Describe the two possible explanations for this phenomenon.

b. One study found that the elderly who do not have children dissave at about the same rate as the elderly who do have children. What might this finding imply about the validity of the two explanations? Why might it be inconclusive?

8. Consider two savings accounts that pay the same interest rate. One account lets you take your money out on demand. The second requires that you give 30-day advance notification before withdrawals.

a. Which account would you prefer? Why?

b. Can you imagine a person who might make the opposite choice? Explain.

c. What do these choices say about the theories of the consumption function discussed in this chapter?

9. This problem requires the use of calculus to solve some consumer optimization problems.

a. Nina has the following utility function:

\[ U = \ln(C_1) + \ln(C_2) + \ln(C_3). \]

She starts with wealth of $120,000, earns no additional income, and faces a zero interest rate. How much does she consume in each of the three periods? (Hint: The marginal rate of substitution between consumption in any two periods is the ratio of marginal utilities.)

b. David is just like Nina, except he always gets extra utility from present consumption. From the perspective of period one, his utility function is

\[ U = 2 \ln(C_1) + \ln(C_2) + \ln(C_3). \]

In period one, how much does David decide to consume in each of the three periods? How much wealth does he have left after period one?

c. When David enters period two, his utility function is

\[ U = \ln(C_1) + 2 \ln(C_2) + \ln(C_3). \]

How much does he consume in periods two and three? How does your answer here compare to David's decision in part (b)?

d. If, in period one, David were able to constrain the choices he can make in period two, what would he do? Relate this example to one of the theories of consumption discussed in the chapter.
KEY CONCEPTS

Business fixed investment  Corporate income tax  Production smoothing
Residential investment  Investment tax credit  Inventories as a factor of production
Inventory investment  Stock  Stock-out avoidance
Neoclassical model of investment  Stock market  Work in process
Depreciation  Tobin's q  Efficient markets hypothesis
Real cost of capital  Financing constraints  Work in process
Net investment

QUESTIONS FOR REVIEW

1. In the neoclassical model of business fixed investment, under what conditions will firms find it profitable to add to their capital stock?

2. What is Tobin's $q$, and what does it have to do with investment?

3. Explain why an increase in the interest rate reduces the amount of residential investment.

4. List four reasons firms might hold inventories.

PROBLEMS AND APPLICATIONS

1. Use the neoclassical model of investment to explain the impact of each of the following on the rental price of capital, the cost of capital, and investment.
   a. Anti-inflationary monetary policy raises the real interest rate.
   b. An earthquake destroys part of the capital stock.
   c. Immigration of foreign workers increases the size of the labor force.
   d. Advances in computer technology make production more efficient.

2. Suppose that the government levies a tax on oil companies equal to a proportion of the value of the company's oil reserves. (The government assures the firms that the tax is for one time only.) According to the neoclassical model, what effect will the tax have on business fixed investment by these firms? What if these firms face financing constraints?

3. The IS–LM model developed in Chapters 11 and 12 assumes that investment depends only on the interest rate. Yet our theories of investment suggest that investment might also depend on national income: higher income might induce firms to invest more.
   a. Explain why investment might depend on national income.
   b. Suppose that investment is determined by
   
   \[ I = \bar{I} + aY, \]

   where $a$ is a parameter between zero and one, which measures the influence of national income on investment. With investment set this way, what are the fiscal-policy multipliers in the Keynesian-cross model? Explain.
   c. Suppose that investment depends on both income and the interest rate. That is, the investment function is
   
   \[ I = \bar{I} + aY - br, \]
where $a$ is a parameter between zero and one that measures the influence of national income on investment and $b$ is a parameter greater than zero that measures the influence of the interest rate on investment. Use the IS–LM model to consider the short-run impact of an increase in government purchases on national income $Y$, the interest rate $r$, consumption $C$, and investment $I$. How might this investment function alter the conclusions implied by the basic IS–LM model?

4. When the stock market crashes, what influence does it have on investment, consumption, and aggregate demand? Why? How should the Federal Reserve respond? Why?

5. It is an election year, and the economy is in a recession. The opposition candidate campaigns on a platform of passing an investment tax credit, which would be effective next year after she takes office. What impact does this campaign promise have on economic conditions during the current year?

6. The United States experienced a large increase in the number of births in the 1950s. People in this baby-boom generation reached adulthood and started forming their own households in the 1970s.

   a. Use the model of residential investment to predict the impact of this event on housing prices and residential investment.

   b. For the years 1970 and 1980, compute the real price of housing, measured as the residential investment deflator divided by the GDP deflator. What do you find? Is this finding consistent with the model? (Hint: A good source of data is the Economic Report of the President, which is published annually.)

7. U.S. tax laws encourage investment in housing (such as through the deductibility of mortgage interest for purposes of computing income) and discourage investment in business capital (such as through the corporate income tax). What are the long-run effects of this policy? (Hint: Think about the labor market.)
1. Suppose that the tradeoff between unemployment and inflation is determined by the Phillips curve:

\[ u = u^u - \alpha (\pi - E\pi), \]

where \( u \) denotes the unemployment rate, \( u^u \) the natural rate, \( \pi \) the rate of inflation, and \( E\pi \) the expected rate of inflation. In addition, suppose that the Left Party always follows a policy of high money growth and the Right Party always follows a policy of low money growth. What "political business cycle" pattern of inflation and unemployment would you predict under the following conditions?

a. Every four years, one of the parties takes control based on a random flip of a coin. 
(Hint: What will expected inflation be prior to the election?)

b. The two parties take turns.

c. Do your answers above support the conclusion that monetary policy should be set by an independent central bank?

2. When cities pass laws limiting the rent landlords can charge on apartments, the laws usually apply to existing buildings and exempt any buildings not yet built. Advocates of rent control argue that this exemption ensures that rent control does not discourage the construction of new housing. Evaluate this argument in light of the time-inconsistency problem.

3. A central bank has decided to adopt inflation targeting and is now debating whether to target 5 percent inflation or zero inflation. The economy is described by the following Phillips curve:

\[ u = 5 - 0.5 (\pi - E\pi), \]

where \( u \) and \( \pi \) are the unemployment rate and inflation rate measured in percentage points. The social cost of unemployment and inflation is described by the following loss function:

\[ L = u + 0.05 \pi^2. \]

The central bank would like this loss to be as small as possible.

a. If the central bank commits to target 5 percent inflation, what is expected inflation? If the central bank follows through, what is the unemployment rate? What is the loss from inflation and unemployment?

b. If the central bank commits to target zero inflation, what is expected inflation? If the central bank follows through, what is the unemployment rate? What is the loss from inflation and unemployment?

c. Based on your answers to parts (a) and (b), which inflation target would you recommend? Why?

d. Suppose the central bank chooses to target zero inflation, and expected inflation is zero. Suddenly, however, the central bank surprises people with 5 percent inflation. What is unemployment in this period of unexpected inflation? What is the loss from inflation and unemployment?

e. What problem does your answer to part (d) illustrate?

Suppose, for example, that the Fed simply announces that it will follow a zero-inflation policy. Such an announcement by itself cannot be credible. After private agents have formed their expectations of inflation, the Fed has the incentive to renege on its announcement in order to decrease unemployment. [As we have just seen, once expectations are determined, the Fed’s optimal policy is to set inflation at \( \pi = \alpha / (2\gamma) \), regardless of \( E\pi \).] Private agents understand the incentive to renege and therefore do not believe the announcement in the first place.

This theory of monetary policy has an important corollary. Under one circumstance, the Fed with discretion achieves the same outcome as the Fed committed to a fixed rule of zero inflation. If the Fed dislikes inflation much more than it dislikes unemployment (so that \( \gamma \) is very large), inflation under discretion is near zero, because the Fed has little incentive to inflate. This finding provides some guidance to those who have the job of appointing central bankers. An alternative to imposing a fixed rule is to appoint an individual with a fervent distaste for inflation. Perhaps this is why even liberal politicians (Jimmy Carter, Bill Clinton) who are more concerned about unemployment than inflation sometimes appoint conservative central bankers (Paul Volcker, Alan Greenspan) who are more concerned about inflation.\(^9\)

**MORE PROBLEMS AND APPLICATIONS**

1. In the 1970s in the United States, the inflation rate and the natural rate of unemployment both rose. Let’s use this model of time inconsistency to examine this phenomenon. Assume that policy is discretionary.
   a. In the model as developed so far, what happens to the inflation rate when the natural rate of unemployment rises?
   b. Let’s now change the model slightly by supposing that the Fed’s loss function is quadratic in both inflation and unemployment. That is, 
      \[
      L(u, \pi) = u^2 + \gamma \pi^2.
      \]

   Follow steps similar to those in the text to solve for the inflation rate under discretionary policy.
   c. Now what happens to the inflation rate when the natural rate of unemployment rises?
   d. In 1979, President Jimmy Carter appointed the conservative central banker Paul Volcker to head the Federal Reserve. According to this model, what should have happened to inflation and unemployment?

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CHAPTER 19 Government Debt and Budget Deficits | 567

QUESTIONS FOR REVIEW

1. What was unusual about U.S. fiscal policy from 1980 to 1995?
2. Why do many economists project increasing budget deficits and government debt over the next several decades?
3. Describe four problems affecting measurement of the government budget deficit.
4. According to the traditional view of government debt, how does a debt-financed tax cut affect public saving, private saving, and national saving?
5. According to the Ricardian view of government debt, how does a debt-financed tax cut affect public saving, private saving, and national saving?
6. Do you find the traditional or the Ricardian view of government debt more credible? Why?
7. Give three reasons why a budget deficit might be a good policy choice.
8. Why might the level of government debt affect the government’s incentives regarding money creation?

PROBLEMS AND APPLICATIONS

1. On April 1, 1996, Taco Bell, the fast-food chain, ran a full-page ad in the New York Times with this news: "In an effort to help the national debt, Taco Bell is pleased to announce that we have agreed to purchase the Liberty Bell, one of our country’s most historic treasures. It will now be called the Taco Liberty Bell and will still be accessible to the American public for viewing. We hope our move will prompt other corporations to take similar action to do their part to reduce the country’s debt." Would such actions by U.S. corporations actually reduce the national debt as it is now measured? How would your answer change if the U.S. government adopted capital budgeting? Do you think these actions represent a true reduction in the government’s indebtedness? Do you think Taco Bell was serious about this plan? (Hint: Note the date.) Be sure to explain your answers.

2. Draft a letter to the senator described in Section 19-3, explaining the logic of the Ricardian view of government debt and evaluating its practical relevance.

3. The Social Security system levies a tax on workers and pays benefits to the elderly. Suppose that Congress increases both the tax and the benefits. For simplicity, assume that Congress announces that the increases will last for only one year.

   a. How do you suppose this change would affect the economy? (Hint: Think about the marginal propensities to consume of the young and the old.)

   b. Does your answer depend on whether generations are altruistically linked?

4. Some economists have proposed the rule that the cyclically adjusted budget deficit always be balanced. Compare this proposal to a strict balanced-budget rule. Which is preferable? What problems do you see with the rule requiring a balanced cyclically adjusted budget?

5. Find some recent projections for the future path of the U.S. government debt as a percentage of GDP. What assumptions are made about government spending, taxes, and economic growth? Do you think these assumptions are reasonable? If the United States experiences a productivity slowdown, how will reality differ from this projection? (Hint: A good place to look is www.cbo.gov.)
6. Policymakers can respond to a financial crisis in three ways. First, they can use conventional monetary and fiscal policy to expand aggregate demand. Second, the central bank can provide liquidity by acting as a lender of last resort. Third, policymakers can use public funds to prop up the financial system.

7. Preventing financial crises is not easy, but policymakers have tried to reduce the likelihood of future crises by focusing more on regulating shadow banks, by restricting the size of financial firms, by trying to limit excessive risk taking, and by reforming the regulatory agencies that oversee the financial system.

**KEY CONCEPTS**

<table>
<thead>
<tr>
<th>Financial system</th>
<th>Risk averse</th>
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<tbody>
<tr>
<td>Financial markets</td>
<td>Diversification</td>
</tr>
<tr>
<td>Bond</td>
<td>Mutual funds</td>
</tr>
<tr>
<td>Stock</td>
<td>Asymmetric information</td>
</tr>
<tr>
<td>Debt finance</td>
<td>Adverse selection</td>
</tr>
<tr>
<td>Equity finance</td>
<td>Moral hazard</td>
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<tr>
<td>Financial intermediaries</td>
<td>Financial crisis</td>
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<td></td>
<td>Speculative bubble</td>
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<td></td>
<td>Leverage</td>
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<td></td>
<td>Fire sale</td>
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<td></td>
<td>Liquidity crisis</td>
</tr>
<tr>
<td></td>
<td>Lender of last resort</td>
</tr>
<tr>
<td></td>
<td>Shadow banks</td>
</tr>
</tbody>
</table>

**QUESTIONS FOR REVIEW**

1. Explain the difference between debt finance and equity finance.

2. What is the main advantage of holding a stock mutual fund over an individual stock?

3. What are adverse selection and moral hazard? How do banks mitigate these problems?

4. How does the leverage ratio influence a financial institution's stability in response to bad economic news?

5. Explain how a financial crisis reduces the aggregate demand for goods and services.

6. What does it mean for a central bank to act as lender of last resort?

7. What are the pros and cons of using public funds to prop up a financial system in crisis?

**PROBLEMS AND APPLICATIONS**

1. In each of the following cases, identify whether the problem is adverse selection or moral hazard, and explain your answer. How might the problem be dealt with?
   a. Rick has gotten a large advance to write a textbook. With the money in hand, he prefers spending his time sailing rather than sitting in his office working on the book.
   b. David is trying to get a large advance to write a textbook. He knows, but publishers don’t, that he did poorly on the writing portion of the SAT.
   c. Brenda is buying a life insurance policy. She knows that members of her family tend to die young.
d. Maria, who has a large life insurance policy, spends her vacation pursuing her favorite hobbies: skydiving, bungee jumping, and bullfighting.

2. Nation A has a well-developed financial system, where resources flow to the capital investments with the highest marginal product. Nation B has a less developed financial system from which some would-be investors are excluded.

a. Which nation would you expect to have a higher level of total factor productivity? Explain. (Hint: See the appendix to Chapter 9 for the definition of total factor productivity.)

b. Suppose that the two nations have the same saving rate, depreciation rate, and rate of technological progress. According to the Solow growth model, how does output per worker, capital per worker, and the capital-output ratio compare in the two countries?

c. Assume the production function is Cobb–Douglas. Compare the real wage and the real rental price of capital in the two countries.

d. Who benefits from having a better-developed financial system?

3. Some commentators argue that when a financial firm is rescued by the government in the midst of a financial crisis, the firm’s equity holders should be wiped out, but the firm’s creditors should be protected. Does this solve the moral hazard problem? Why or why not?

4. In recent years, as described in this chapter, both the United States and Greece have experienced increases in government debt and a significant economic downturn. In what ways were the two situations similar? In what ways were they different? Why did the two nations have different policy options at their disposal?